QUESTIONS AND ANSWERS ABOUT A
CANADIAN POLAR INFORMATION SYSTEM

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In 1987 the Minister of Indian and Northern Affairs released the report *Canada and Polar Science* (Adams et al, 1987), which examined the state of polar research in Canada. One of the observations of the authors of this work was that Canada lacks a comprehensive multidisciplinary polar information system, and that such a system is a necessary part of the infrastructure required to encourage excellence in Canadian polar research. The authors recommended that a Canadian Polar Information System (CPIS) be established. A follow-up study, *The Shield of Achilles: The Report of the Canadian Polar Research Commission Study* (Symons and Burnet, 1988), recommended that feasibility studies on the creation of a CPIS be undertaken soon. Both of these reports noted that the idea of a CPIS enjoys wide support, but did not discuss in detail what form a Canadian Polar Information System might take nor what types of information it might include.

Our two institutes, the Boreal Institute for Northern Studies (Boreal) and the Arctic Institute of North America (AINA), are keenly interested in the concept of a CPIS. Each institute serves a large community of users involved in polar research, and, while each has maintained a separate multidisciplinary polar database for over a decade, we believe the needs of Canadian polar researchers would best be served by a single database with numerous contributors. Our databases, BOREAL and ASTIS, are the only large publicly accessible polar databases in Canada, containing over 60,000 unique records between them. We have demonstrated (Minion and Goodwin, 1987, 1988) that their merger is feasible, and have proposed that the resulting database form the core of a CPIS. The authors of *The Shield of Achilles* acknowledged and supported the interest our two institutes have shown in taking a leadership role in the development of a CPIS.

We believe, however, that while BOREAL and ASTIS can provide the core, the development and success of a CPIS requires more than the resources available at our two institutes. Many people and organizations must participate in the design and operation of such a system, and the planning process must have the widest possible involvement of polar information centres and polar information users across Canada. In an effort to involve other individuals and institutions the authors of this paper have presented a paper on CPIS major international conference, conferred with staff at the National Library, surveyed other Canadian

polar information centres and travelled to Yellowknife to discuss CPIS with librarians and others in the Northwest Territories.

The next logical step in this consultation process is to involve individuals and institutions from Quebec. The recent DIAND report *Enquête sur les collections nordiques au Québec* (Robitaille, 1988) identifies which organizations in Quebec hold significant amounts of polar information. Quebec has a large number of active northern researchers who are not only potential users of a CPIS but who produce important material which must be included in such a system. Now is the time to build a consensus on mechanisms for Quebec participation in a CPIS. Work in the area of language standards also needs to be undertaken, and individuals and organizations within Quebec must be involved in these decisions.

This paper is a working document that records our current thinking on many of the questions that must be addressed before a detailed design for a CPIS can be prepared. The initial version was presented and discussed at a meeting of the N.W.T. Library Association in Yellowknife in September 1988, and in individual meetings with Yellowknife librarians. Version 2 of the paper hopefully incorporates the opinions expressed in those meetings, and includes more detailed discussions of several questions. It has been prepared for a workshop in Quebec in March 1989. There are many other major Canadian polar information centres that will then still remain to be consulted, especially those in the National Capital Region, but also in Newfoundland and Labrador, at Lakehead University and in the Yukon. None of the answers in this paper will be complete without the participation of all interested parties.

In preparing this paper, we have tried to avoid unspoken assumptions by including even those questions for which the answer seems obvious. Where possible we have first given the short answer to a question, and then have followed it with our reasons for choosing that answer. We have noted those areas in which we ourselves are not yet in agreement. This is a discussion paper. We encourage the reader to suggest additional questions and answers.

Who Will Use CPIS?

CPIS should be usable by anyone with a need for information about the polar regions. There are a number of user groups for whom CPIS would be valuable, including researchers and decision-makers in government and industry, faculty and students at educational institutions, native organizations, public interest groups and members of the public. The needs and expectations of such groups, and their level of experience with information retrieval techniques, vary considerably. University researchers with well-established programs, well-developed networks of personal contacts and large academic libraries close at hand may need sources for identifying ephemeral "gray" literature. Industry researchers beginning a project on a new subject may need an overview of the "core" literature, or a list of the current experts in that field. Research managers or funders in government may want to know what research projects are being conducted in a particular subject or geographic area. Some members of these groups may want to conduct their own searches of an online database, others may want to scan printed lists of information, and still others may only want to deal with CPIS through a human intermediary.

CPIS must be available for use by anyone. The range of people who must be accommodated varies from sophisticated online searchers to those with no knowledge whatsoever regarding online retrieval systems. Assistance in conducting searches must be available for those requiring it. Although anyone should be able to use CPIS, the heaviest users of the system will be librarians, researchers and post-secondary students. The structure and content of CPIS should reflect this. It is unlikely that the general public will place large demands on the system and there is agreement that the recreational reading needs of Northerners are not a high priority. The public library systems in Northern Canada are developing quickly and are doing an excellent job in filling this need.

What Types of Information Will CPIS Contain?

"Information" means different things to different people. What types of information would potential users want to find in CPIS?

Should CPIS Contain Bibliographic Information?

Yes. It is generally agreed that CPIS will contain citations to information in printed form. When possible, citations will be accompanied by annotations or abstracts, and eventually some of them will also be accompanied by the full text of the cited document. Newspaper and newsletter stories may be included in CPIS although they will receive only abbreviated treatment. CPIS will provide a means of including or excluding specified formats of bibliographic material from any search result.

Citations will contain location codes indicating libraries that hold the document. Multiple location codes will be provided in an attempt to reduce heavy borrowing from a single library. Every effort will be made to provide locations for all documents, but we are not yet in agreement about whether documents for which a library location is not yet known (for example, a document seen in a researcher's office collection) should be excluded from the database. A document delivery system is a long term objective of CPIS. Current methods of Interlibrary Loan either by mail or electronic messaging will be sufficient in the short term.

Should CPIS Contain Descriptions of Research Projects?

Yes. Information about many current research projects is readily available from agencies that fund and licence research, and making this information available would fill the two- or three-year gap until the results of the research are published. Research project descriptions should be removed from CPIS after the results of the research are published and are added to the database as a bibliographic record. In practise it may be difficult to establish which, if any, research project resulted in a publication, so considerable thought must be given to CPIS's policies in this regard.

Should CPIS Contain a Directory of Experts?

Possibly. In many cases the best way to answer a user's question is to direct him to an expert. Such a directory could be thought of as an automated version of the *List of Northern Specialists at Canadian Universities* (ACUNS, 1983), expanded to include government and private-sector experts. Directories, however, must be kept extremely current if they are to be of value. All individuals included in a directory must be approached beforehand and agree to the listing. Resources for maintaining the directory must be present before this aspect of CPIS is implemented.

Should CPIS Contain a Directory of Organizations?

Yes. Such a directory would list northern information centres, organizations that conduct research in the North, and perhaps also agencies that have policy or management responsibilities in the North. A directory of organizations is not as difficult to maintain as a directory of experts and therefore should be implemented first. The scope of this part of CPIS would require careful definition. Should non-Canadian organizations be included? Should the parameters for inclusion be the same for Canadian and non-Canadian organizations?

Should CPIS Contain Numeric Data?

No. For those disciplines in which large amounts of numeric data are generated there are usually existing data archives that researchers should use. Archiving and distribution of this type of information is best undertaken by experts who can also assist with the analysis of the data. However, CPIS should contain references to data sets thus informing researchers of their existence and location.

Should CPIS Include a Geographic Information System?

No. GIS's, which store and present information in the form of maps, are relatively expensive to develop and maintain. They are only cost-effective for regions that are being managed intensively; that is, for regions in which frequent land use decisions are necessary. Various agencies have proposed the development of GIS's for particular parts of northern Canada, and CPIS would act as a source of information for such systems. CPIS should not itself include a GIS.

Should CPIS Include Electronic Mail, Computer Conferencing, and/or Computer Bulletin-Board Facilities?

No. Such services are, in most cases, available to researchers and decision-makers from other, usually discipline-oriented, sources. While northern researchers, and researchers in general, should probably be making greater use of such services, we are not proposing that CPIS undertake such a mission.

Assuming that CPIS contains more than one of the above types of information, the user should be able to retrieve all types of information about a particular subject or geographic area without having to switch to a different CPIS database or CPIS publication. For example, an online search on a topic should, unless the user chooses to restrict it by information type, return citations to all documents about that topic, descriptions of all research projects on that topic and listings for all organizations concerned with that topic.

What Subjects Will CPIS Cover?

All of them. CPIS must be "concerned with the full range of knowledge in and about the polar regions". (Symons and Burnet, 1988, p. 9) This includes the sciences, social sciences, humanities, technology, policy issues, traditional knowledge, etc.

What Geographic Area Will CPIS Cover?

In defining the geographical limits of CPIS a very broad definition of "the North" should be used. The geographical limits of "nordicity" developed by Louis-Edmond Hamelin (Symons and Burnet, 1988, p. 10) are felt by many to best define the Canadian North. CPIS should cover this region, plus all adjacent ocean areas. CPIS should also cover information produced in Canada about the polar regions in general or polar problems in general, but which does not refer to any specific location in northern Canada.

There is strong support for including information about polar regions and problems in general which is produced outside Canada. The first priority of CPIS must be information relating specifically to Canadian polar regions. However, just as polar research crosses disciplines, it also crosses national boundaries and much can be learned from research conducted in other locations. Serving the user is the primary goal of CPIS and until the polar literature of other countries is easily accessible to Canadian users CPIS should include some non-Canadian polar information. Links with other polar information systems must be pursued and promoted. The possibility of working with institutions in other countries to create an international polar database should be actively explored.

How Comprehensive Will CPIS Be?

As an information system becomes more comprehensive new items of information become harder to find and the unit cost of finding each item begins to rise. In any system with as broad a mandate as CPIS the last few percent of items cannot be found at any reasonable price. CPIS cannot be totally comprehensive. Should it have stated numeric goals for comprehensiveness? Is there any way to measure whether such goals have been achieved?

What Products and Services Will CPIS Provide?

In order to be useful CPIS must be accessible to its users through a wide variety of products and services. What products and services do potential users want?

An Online Database?

Yes. The database should be available from as many online vendors as possible, bearing in mind that each vendor must be ensured a reasonable amount of revenue from the database. Some of the vendors must be Canadian. The database should be updated monthly, if not more frequently. It will also be important to ensure that proper data communication networks through which CPIS can be accessed are established in those areas not yet adequately provided with such services.

A CD-ROM Database?

Yes. By the time CPIS is in operation there should be enough CD-ROM readers in use, and CD-ROM mastering costs should be low enough, that this will be a cost-effective method of distributing the database. Will annual updating of a CD-ROM be frequent enough, or will quarterly updating be necessary?

Online Searches Conducted by CPIS Staff?

Yes. Users who do not have the equipment or training to conduct their own online searches should be able to phone, fax, E-mail or write CPIS and have the results returned by fax, E-mail, courier or mail.

A Printed Current Awareness Bulletin?

Yes. Probably monthly.

A Selective Dissemination of Information Service?

Perhaps. This would in effect be a current awareness bulletin customized to a user's area of subject or geographic interest. It might not be needed if the SDI services provided by some of the online vendors were judged to be "user-friendly" enough.

A Cumulation of the Entire Database on Microfiche?

No. A fiche cumulation is working well for ASTIS at the present time, but CPIS would be too large for such a product to be produced at a reasonable cost.

An Annual Printed "Bibliography"?

Perhaps. Such a product seems to be working well in the cases of *Antarctic Bibliography* and *Bibliography on Cold Regions Science and Technology*.

As an information service, CPG must strive to be comprehensive over areas of information because that and the sole sort of finding tools that feature at this. In any system with as broad a mission as CPG, not but few prove useful to each in any reasonable sense. CPG cannot be easily comprehensive. Should it have stated measurable goals for service improvement? Is there any way to measure whether such goals have been achieved.

What Products And Services Will CPG Provide?

In order to serve its, CPG must be marketable to its users through a wide variety of products and services. What products and services do potential users want?

An Online Catalog?

Yes. The database should be available forms in some online searches in or example, because in terms that each vendor needs to distribute a reasonable amount of revenues from the database. Some of this vendors may be Canadian. This database should be updated annually, if not more frequently. It will also be important to assure that proper dissemination strategies through which CPG can be accessed are established in those areas not presently provided with such services.

A CD-ROM Database?

Yes. By the time CPG is in operation in there should be enough CD-ROM readers in use, and CD-ROM resources could be low enough, that this will be a cost-effective manner of dissemination by the end. Will several updates of a CD-ROM be frequent enough, or will quarterly updating be necessary?

Online Searches Conducted by CPG Staff?

Yes. Users who do not have the equipment or training to conduct their own online searches should be able to phone, fax, E-mail or write CPG and have the results returned by fax, Overall, courier or e-mail.

A Printed Current Awareness Bulletin?

Yes. Probably monthly.

A Selective Dissemination of Information Service?

Perhaps. This would be offered in a current awareness bulletin customary to a part if one of the for its population at least. It might not be necessary if the SDI services provided by some of the parties were such as to cover the need already, example.

A Compilation of the Entire Database on Microfiche?

No. A microfiche form is worthless even for ASPIS at the present time, but CPG would be unwise for such a product to be produced at a reasonable cost.

An Annual Printed Volume, Maybe?

Perhaps. Such a product needs to be worthless well in the areas of whatever fields typesetting and online by only on Code Regulations Science and Technology.

Special "Bibliographies" on Topics of Current Importance?

Probably. There always seems to be a demand for these.

Subsets of the Database in Machine-Readable Form?

Yes. Parts of CPIS database would be available for sale on magnetic tape or floppy disk at negotiated prices.

What Languages Will CPIS Support?

French and English

As a national system CPIS will fully support both official languages. At a minimum this support will include the following:
- Access to CPIS staff for general inquiries and custom searches will be available in both languages.
- All CPIS user documentation, covers and introductory pages of publications, marketing materials, etc. will be available in both languages.
- Command languages for interacting with the online database on Canadian vendors will be available in both languages. Command languages for interacting with the CD-ROM database will also be available in both languages.
- CPIS records, in both online and printed form, will follow the policies of the National Library with regard to the languages used in cataloguing and indexing of information. (National Library, 1988, Appendix E.1) Simplified, these policies are that descriptive cataloguing (title, author, notes, etc.) and abstracts of English items will be in English, of French items in French, of bilingual English/French items in both languages (two separate records for each item), and of items in other languages in English. Controlled vocabulary indexing (e.g. subject terms) will be provided in both languages for all items.
- Accents will be supported in all printed products. Support for accents in the online database is up to the online vendors. Neither of the two major Canadian vendors, CAN/OLE and QL Systems, supports accents at this time, but will be encouraged to develop this facility. Accents will also be supported in the CD-ROM version of the database.

Optionally, and at increased cost, CPIS could provide the following additional levels of support:
- All title fields in both languages.
- All abstracts in both languages.

Decisions about these optional additional levels of support will presumably be made by whatever agencies fund CPIS, and will be based on the amount of funding that is available.

Native Languages

Native language information will be included in CPIS, but so far the consensus seems to be that native languages will not require the level of support afforded French or English. So, for example, a bibliographic record might have the title in a native language, but would have a title translation and abstract in French or English. Syllabic material will be translated rather than transliterated. Part-time native-speaking staff will be hired whenever possible to assist both in indexing and in providing services to Native users who do not speak either English or French.

Other Languages

CPIS will follow the policies of the National Library with regard to such material. Transliteration standards must be chosen for languages that do not use roman letters.

What Methods of Subject and Geographic Access Will a CPIS Use?

While CPIS users will look for work done by a specific person or for a report or research project with a specific title, it is expected that many inquiries of both the online database and the printed "bibliographies" will be for information about a particular subject or geographic area. Successful retrieval from CPIS, and the success of CPIS as a whole, therefore depends on choosing effective methods for subject and geographic access. The two major existing polar databases in Canada, BOREAL and ASTIS, use different subject/geographic access methods. Moreover, there are two additional access methods that deserve serious consideration, making a total of four possibilities. Choosing a subject/geographic access method is the major unresolved problem in the CPIS design, and will require further study.

No matter which method of detailed subject/geographic access is used we are assuming that CPIS will also use a small number of broad subject and geographic category codes. These would be similar to the 24 subject codes and 28 geographic codes now used by ASTIS, and would be used to allow searching on very broad disciplines or geographic regions, to divide the current awareness bulletin into sections, to provide cross-checking with the detailed access terms and for statistical purposes.

The four subject/geographic access methods that should be considered for possible use in CPIS are described below. All except the first involve the adding of terms from a controlled subject and geographic vocabulary to each database record as it is entered. Effective retrieval therefore depends on the searcher using the controlled vocabulary terms, although some methods are more forgiving in this regard than others. (Hybrid systems, that add both controlled and uncontrolled terms to records, are also possible with each of these three methods.) It should be noted that it is not possible to automatically translate between these controlled vocabularies, since the correspondence between terms is often not one-to-one. This means that conversion of records that use a different controlled vocabulary than CPIS does, whether older records or records coming from other systems, will require some manual labour.

More specialized methods of geographic access could be used with any of the four methods listed below, at some additional cost. Records that refer to relatively narrow geographic locations could be coded with latitudes and longitudes, or with National Topographic System map sheet numbers. Such methods are usually not very useful when records refer to large geographic areas.

No Controlled Vocabulary

The simplest and cheapest method of subject/geographic access would be to add no subject or geographic information to the records beyond the broad category codes described above. Because less work would be required per record, and because employees with lower skill levels could be used, this method would provide a cost saving of 20%-30% per record when compared with any of the other methods.

The disadvantage of this method is that retrieving information from CPIS could be very difficult. In the online and CD-ROM versions of the database retrieval would be based on words used in the title and abstract of the record. Retrieval therefore would depend on the "author" having done a good job of choosing a title and writing an abstract, and on the searcher thinking of every possible combination of words that could have been used to express a concept and combining those words in a well-constructed Boolean search. For some scientific and technical fields this method can work quite well. In the social sciences, humanities and policy areas it often results in many relevant records being missed and many irrelevant records being retrieved. This method would also prohibit subject and geographic indexes in printed "bibliographies", because KWIC or KWOC indexes on titles, the only possibilities, offer poor retrieval and are impossibly large for any reasonable-sized "bibliography".

Universal Decimal Classification for Use in Polar Libraries

The *Universal Decimal Classification for Use in Polar Libraries* (UDC) was developed at the Scott Polar Research Institute (SPRI) in Cambridge, England in the 1950's. It is currently used by the SPRI Library, the Boreal Institute Library (of which the BOREAL database is the catalogue) and several smaller polar libraries. UDC uses strings of numbers as subject and geographic terms. A searcher must look up the desired concepts in a code book or a separate online database in order to find the appropriate numbers, and then search the main database using those numbers. One of its disadvantages, therefore, is that searching is always a two-step process. The number code must be located before a search can be conducted. If word-based subject and geographic access is used the user is more likely to guess the appropriate term. Moreover, words are more easily remembered than numbers.

A number system has the advantage of being language-independent though. While the code book would have to be multilingual, a unilingual searcher would not have to know the appropriate terms in another language since the number assigned would be the same in all cases. Moreover, changes in terminology are often easier to achieve without changing the actual database records. The language used in the code book can be altered or added to without necessarily causing a change in the numbers. For example, the terms Inuit and Eskimo can both be used in the codebook and refer to the same number. Another advantage of a hierarchical number-based system such as UDC is that it is easy to search on related terms. Most related terms use the same base number, and truncation searching allows easy retrieval of broad categories of related material.

In general the concepts used in UDC are broader than those that would be used in a thesaurus. This makes indexing slightly cheaper but retrieval on very specific topics more difficult. Because the BOREAL database is the largest group of older records to be added to CPIS, use of UDC would minimize conversion costs. UDC is not suitable for use in the indexes of printed "bibliographies".

Enhanced Canadian Subject Headings

The *Canadian Subject Headings* (CSH) have been developed by the National Library to complement the *Library of Congress Subject Headings* (LCSH) for Canadian topics. The equivalent French headings are *Répertoire de vedettes-matière* compiled by the Laval University library. Taken together, these three lists of subject headings are used by virtually all large academic libraries in Canada, and form the basis of the subject headings used by many special libraries, including, for example, most of the special libraries in the N.W.T. As they stand, CSH are not very suitable for use in a polar database, since they lack much of the necessary polar scientific and technical terminology. For this reason polar special libraries using CSH are forced to add significant numbers of new headings. Since each library adds headings in its own way the resulting lists of subject headings are very different.

A possible solution is to ask the National Library to add the missing polar headings to the official CSH. This would provide polar subject headings that all Canadian libraries could use, and, if CPIS and the libraries contributing to it used these headings, CPIS could use incoming records without changing the subject/geographic indexing. (This advantage would apply only to books, which would be less than half of the records in the bibliographic component of CPIS. The majority of bibliographic records would be journal articles and conference papers, which most libraries do not catalogue.) Before approaching the National Library with such a request we must have a good idea of the number and type of headings to be added, something we have not yet had time to work on. At this point, however, we tend to be pessimistic about the chances that such major additions could be made to CSH.

CSH is the best of the four methods for the indexes of printed "bibliographies", since it was created for use in manual card catalogues, but it is not ideally suited to online searching. (Interestingly, now that most large libraries have switched to online catalogues there are moves afoot to make LCSH, and presumably CSH, more like a thesaurus.) There is a large pool of trained CSH cataloguers available. CSH would improve retrieval even for those searchers who did not bother to look up the correct headings, although it would not be as good as a thesaurus in this regard.

A Thesaurus

During the past 20 years thesauri have become the most common method for providing subject access to online bibliographic databases. The standards and methods for developing and maintaining thesauri, including multilingual thesauri, are well established. Thesauri are used by the ASTIS database and by COLD, the world's largest polar database. Online retrieval systems are now available that can make use of the information in a thesaurus to quickly narrow or broaden a search, to search related terms, and to automatically handle synonyms. (Not in CAN/OLE or QL yet, unfortunately.) Because the terms in a thesaurus are kept up-to-date with current terminology their addition to records will assist even those searchers who do not consult the thesaurus. A thesaurus could contain more, and more detailed, terms than either UDC or CSH, thus providing good access to very detailed concepts but at a slight increase in indexing costs.

Thesaurus terms are acceptable for use in the indexes of printed "bibliographies", although they aren't as good as CSH in this regard. In terms of the cost of converting older records a thesaurus would rank second to UDC, since the ASTIS database would require little conversion but BOREAL would require a great deal. A thesaurus offers a good method of subject/geographic access for CPIS, but it would also be somewhat more expensive than either UDC or CSH.

What Will Be the Organizational Structure of CPIS?

CPIS will be directed by a broadly-based Management Committee of information users and information professionals that presumably will report to the Canadian Polar Research Commission. Day-to-day management will be handled by three or four polar information centres that do the assembly of the actual CPIS database and the production of CPIS products. Our two institutes are interested in doing this production work, and it is essential that a Quebec information centre participate as well. We hope that in the longer term organizations based in the North will take over some of the CPIS production work. We are assuming for now that the production version of the CPIS database will use the SPIRES database management system at the University of Alberta, which is used to produce both BOREAL and ASTIS. All information will enter the database via one of the production centres, which will enter records online directly into SPIRES. The production centres could divide the work by a combination of form (AINA doing analytics, Boreal doing monographs), language (AINA and Boreal doing English, someone in Quebec doing French), subject, or geographic area.

All polar information centres in Canada contain at least some unique information, and the amount of information that is not held at any of the production centres will be considerable. A CPIS that is close to comprehensive must therefore obtain information from many small and medium-sized polar information centres. The support for CPIS among these information centres is very encouraging, based on the discussions we have had with them so far. Many have indicated their willingness to supply CPIS with information. It is hoped that CPIS will be able to provide small amounts of funding to cover the costs of such work. Contributors could also be given special privileges such as reduced search charges.

Information will be submitted to the appropriate production centre in either machine-readable form or on paper, depending on the capabilities of the contributor. The production centres will eliminate duplication, identify and fill gaps, and convert all information to a consistent format. The formats of the different record types in CPIS will be determined based on the anticipated needs of users, the formats used by potential contributors, the advice of appropriate technical experts, and the expected costs. The bibliographic component of CPIS will not be a union catalogue. Contributors will typically be submitting only a small fraction of the items in their catalogues. Whenever possible contributors will be assigned subject or geographic areas of responsibility in order to reduce duplication in the information arriving at the production centres.

How Much Will CPIS Cost?

That depends on the answers to all of the above questions. Probably between $500,000 and $1,000,000 per year. Part of the cost of operating CPIS will be recovered through sales of products, but a significant subsidy will always be required.

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This depends on the answers to all of the above questions. Assuming between $50,000 and $100,000 per year. Part of the cost of operating CRMS will be recovered through sales of services, but the net cost to industry will always be negative.

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